Icarus

INTERNATIONAL JOURNAL OF SOLAR SYSTEM STUDIES

Volume 44 • 1980

EDITOR: *Joseph A. Burns*
Space Science Building
Cornell University
Ithaca, New York 14853

ACADEMIC PRESS
A Subsidiary of Harcourt Brace Jovanovich, Publishers
New York London Toronto Sydney San Francisco

Copyright © 1980 by Academic Press, Inc.

ALL RIGHTS RESERVED

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the copyright owner.

The appearance of the code at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use, or for the personal or internal use of specific clients. This consent is given on the condition, however, that the copier pay the stated per copy fee through the Copyright Clearance Center, Inc. (21 Congress Street, Salem, Massachusetts 01970), for copying beyond that permitted by Sections 107 or 108 or the U.S. Copyright Law. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. Copy fees for pre-1980 articles are the same as those shown for current articles.

MADE IN THE UNITED STATES OF AMERICA

CONTENTS OF VOLUME 44

NUMBER 1, OCTOBER 1980

PREFACE

HERBERT A. BEEBE AND RETA F. BEEBE. Pluto—The Ninth Planet's Golden Year 1

CLYDE W. TOMBAUGH. Some Early Vexing Optical and Mechanical Problems of the 13-Inch "Pluto" Telescope 2

H. L. GICLAS. History of the 13-Inch Photographic Telescope and Its Use Since the Discovery of Pluto 7

R. L. DUNCOMBE AND P. K. SEIDELMANN. A History of the Determination of Pluto's Mass 12

P. K. SEIDELMANN, G. H. KAPLAN, K. F. PULKKINER, E. J. SANTORO, AND T. C. VAN FLANDERN. Ephemeris of Pluto 19

B. G. MARSDEN. Planets and Satellites Galore 29

JAMES W. CHRISTY AND ROBERT S. HARRINGTON. The Discovery and Orbit of Charon 38

MARK J. LUPO AND JOHN S. LEWIS. Mass–Radius Relationships and Constraints on the Composition of Pluto, II 41

EDWIN S. BARKER, WILLIAM D. COCHRAN, AND ANITA L. COCHRAN. Spectrophotometry of Pluto from 3500 to 7350 Å 43

L. TRAFTON. Does Pluto Have a Substantial Atmosphere? 53

REGULAR ARTICLES

UWE FINK, BRADFORD A. SMITH, D. CHRIS BENNER, JAMES R. JOHNSON, H. J. REITSEMA, AND JAMES A. WESTPHAL. Detection of a CH_4 Atmosphere on Pluto 62

LOUIS A. CAPONE, JOHN DUBACH, ROBERT C. WHITTEN, SHEO S. PRASAD, AND KRISHNAMURTHY SANTHANAM. Cosmic Ray Synthesis of Organic Molecules in Titan's Atmosphere 72

R. C. WHITTEN AND W. C. KNUDSEN. Simple Models of the Thermal Structure of the Venusian Ionosphere 85

ALAN T. TOKUNAGA, R. F. KNACKE, AND S. T. RIDGWAY. High Spatial and Spectral Resolution 10-μm Observations of Jupiter 93

THOMAS F. GREENE, DALE W. SMITH, AND RICHARD W. SHORTHILL. Galilean Satellite Eclipse Studies. I. Observations and Satellite Characteristics ... 102

DALE W. SMITH. Galilean Satellite Eclipse Studies. II. Jovian Stratospheric and Tropospheric Aerosol Content 116

DALE W. SMITH AND THOMAS F. GREENE. Galilean Satellite Eclipse Studies. III. Jovian Methane Abundance 134

AKIRA FUJIWARA AND AKIMASA TSUKAMOTO. Experimental Study on the Velocity of Fragments in Collisional Breakup 142

GLEN R. STEWART AND WILLIAM M. KAULA. A Gravitational Kinetic Theory for Planetesimals 154

S. J. WEIDENSCHILLING. Dust to Planetesimals: Settling and Coagulation in the Solar Nebula 172

D. W. SEARS. Thermoluminescence of Meteorites: Relationships with Their K–Ar Age and Their Shock and Reheating History 190

HORTON E. NEWSOM. Hydrothermal Alteration of Impact Melt Sheets with Implications for Mars 207

ELLIOT C. MORRIS AND KENNETH L. JONES. Viking 1 Lander on the Surface of Mars: Revised Location 217

BOOK REVIEWS

DALE P. CRUIKSHANK. *Planets X and Pluto,* William G. Hoyt 223
ROBERT S. HARRINGTON. *The Planet Pluto,* A. J. Whyte 224

NUMBER 2, NOVEMBER 1980

EDITORIAL 225
DAVID MORRISON AND C. M. TELESCO. Io: Observational Constraints on Internal Energy and Thermophysics of the Surface 226
RAY T. REYNOLDS, STANTON J. PEALE, AND PATRICK CASSEN. Io: Energy Constraints and Plume Volcanism 234
G. W. LOCKWOOD, K. LUMME, AND D. T. THOMPSON. The Recent Photometric Variability of Io 240
JAMES B. POLLACK AND FRED C. WITTEBORN. Evolution of Io's Volatile Inventory 249
GARY D. CLOW AND MICHAEL H. CARR. Stability of Sulfur Slopes on Io 268
STEVEN W. LEE AND PETER C. THOMAS. Near-Surface Flow of Volcanic Gases on Io 280
A. J. DESSLER. Mass-Injection Rate from Io into the Io Plasma Torus 291
FLOYD HERBERT AND BERNARD R. LICHTENSTEIN. Joule Heating of Io's Ionosphere by Unipolar Induction Currents 296
B. A. GOLDBERG, YU. MEKLER, R. W. CARLSON, T. V. JOHNSON, AND D. L. MATSON. Io's Sodium Emission Cloud and the Voyager 1 Encounter 305
L. TRAFTON. An Explanation for the Alternating North–South Asymmetry of Io's Sodium Cloud 318
E. GRÜN, G. MORFILL, G. SCHWEHM, AND T. V. JOHNSON. A Model of the Origin of the Jovian Ring 326
JOSEPH A. BURNS, MARK R. SHOWALTER, JEFFREY N. CUZZI, AND JAMES B. POLLACK. Physical Processes in Jupiter's Ring: Clues to Its Origin by Jove! 339
J. G. LUHMANN AND R. J. WALKER. Some Possible Effects of Jupiter's Rings on the Jovian Inner Plasmasphere 361
J. B. BLAKE AND MICHAEL SCHULZ. The Satellites of Jupiter as a Source of Very Energetic Magnetospheric Particles 367
J. GRADIE, P. THOMAS, AND J. VEVERKA. The Surface Composition of Amalthea 373
ROGER N. CLARK. Ganymede, Europa, Callisto, and Saturn's Rings: Compositional Analysis from Reflectance Spectroscopy 388
L. A. MCFADDEN, J. F. BELL, AND T. B. MCCORD. Visible Spectral Reflectance Measurements (0.33–1.1 μm) of the Galilean Satellites at Many Orbital Phase Angles 410
STEVEN J. OSTRO, DONALD B. CAMPBELL, GORDON H. PETTENGILL, AND IRWIN I. SHAPIRO. Radar Observations of the Icy Galilean Satellites 431
WILLIAM K. HARTMANN. Surface Evolution of Two-Component Stone/Ice Bodies in the Jupiter Region 441
WILLIAM B. MCKINNON AND H. J. MELOSH. Evolution of Planetary Lithospheres: Evidence from Multiringed Structures on Ganymede and Callisto 454

STEVEN W. SQUYRES. Topographic Domes on Ganymede: Ice Vulcanism or Isostatic Upwarping 472
BAERBEL K. LUCCHITTA. Grooved Terrain on Ganymede 481
STEVEN W. SQUYRES. Surface Temperatures and Retention of H_2O Frost on Ganymede and Callisto 502
EDWARD S. GAFFNEY AND DENNIS L. MATSON. Water Ice Polymorphs and Their Significance on Planetary Surfaces 511
J. DEGEWIJ, L. E. ANDERSSON, AND B. ZELLNER. Photometric Properties of Outer Planetary Satellites 520
J. DEGEWIJ, D. P. CRUIKSHANK, AND W. K. HARTMANN. Near-Infrared Colorimetry of J6 Himalia and S9 Phoebe: A Summary of 0.3- to 2.2-μm Reflectances 541

NUMBER 3, DECEMBER 1980

EDITORIAL 549
OWEN B. TOON, JAMES B. POLLACK, WILLIAM WARD, JOSEPH A. BURNS, AND KENNETH BILSKI. The Astronomical Theory of Climatic Change on Mars 552
M. YA. MAROV, V. E. LYSTSEV, V. N. LEBEDEV, N. L. LUKASHEVICH, AND V. P. SHARI. The Structure and Microphysical Properties of the Venus Clouds: Venera 9, 10, and 11 Data 608
JEAN-PAUL PARISOT, GUY MOREELS, AND JEAN-MARC ZUCCONI. Effects of Scattered Solar Radiation and Absorption by SO_2 on the Photodissociation Processes in the Stratosphere of Venus 640
JOSEPH W. CHAMBERLAIN. Exospheric Perturbations by Radiation Pressure. II. Solution for Orbits in the Ecliptic Plane 651
MICHAEL J. PRICE AND OTTO G. FRANZ. Saturn: UBV Photoelectric Pinhole Scans of the Disk, II 657
JOHN CALDWELL, A. T. TOKUNAGA, AND F. C. GILLETT. Possible Infrared Aurorae on Jupiter 667
W. B. HUBBARD AND J. J. MACFARLANE. Theoretical Predictions of Deuterium Abundances in the Jovian Planets 676
JEFFREY N. CUZZI, JAMES B. POLLACK, AND AUDREY L. SUMMERS. Saturn's Rings: Particle Composition and Size Distribution as Constrained by Observations at Microwave Wavelengths. II. Radio Interferometric Observations 683
LARRY P. COX AND JOHN S. LEWIS. Numerical Simulation of the Final Stages of Terrestrial Planet Formation 706
M. TORBETT AND R. SMOLUCHOWSKI. Sweeping of the Jovian Resonances and the Evolution of the Asteroids 722
A. CAZENAVE, A. DOBROVOLSKIS, AND B. LAGO. Orbital History of the Martian Satellites with Inferences on Their Origin 730
H. J. MELOSH. Tectonic Patterns on a Reoriented Planet: Mars 745
JOHN T. WASSON AND PAUL H. WARREN. Contribution of the Mantle to the Lunar Asymmetry 752
RAY T. REYNOLDS, JILL C. TARTER, AND RUSSELL G. WALKER. A Proposed Search of the Solar Neighborhood for Substellar Objects 772
MILO WOLFF. Theory and Application of the Polarization–Albedo Rules 780

VON R. ESHLEMAN, DUANE O. MUHLEMAN, PHILIP D. NICHOLSON, AND PAUL G. STEFFES. Comment on Absorbing Regions in the Atmosphere of Venus as Measured by Radio Occultation 793
ARVYDAS J. KLIORE, CHARLES ELACHI, AND INDU R. PATEL. Reply to "Comment on Absorbing Regions in the Atmosphere of Venus as Measured by Radio Occultation" by V. R. Eshleman *et al.* 804

NOTES
S. J. WEIDENSCHILLING. Hektor: Nature and Origin of a Binary Asteroid 807
P. FARINELLA, A. MILANI, A. M. NOBILI, AND G. B. VALSECCHI. Some Remarks on the Capture of Triton and the Origin of Pluto 810
J. P. LESTRADE AND J. W. CHAMBERLAIN. Effective Depth of Spectral Line Formation in Planetary Atmospheres 813

BOOK REVIEW
RAYMOND E. ARVIDSON. *Geology of the Planet Mars,* Vivien Gornitz, ed.... 816
AUTHOR INDEX FOR VOLUME 44..... 817
CUMULATIVE SUBJECT INDEX FOR VOLUMES 41–44..... 819